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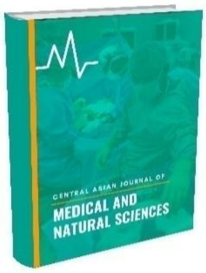

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Regularities of the Structure and Development of the Rat Stomach By 21 Days of Life

1. **Ilyasov A. S.**
2. **Sharifova Sh. K.**

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[1] D. in Biology, Professor, Department of Anatomy Bukhara State Medical Institute

[2] The applicant is a doctor laboratory assistant Republican Scientific Center for Emergency Medical Care Bukhara branch

Abstract: To study anatomico-topographic peculiarities of the rat stomach structure and to determine its growth and development structure regularities in the period of early postnatal ontogenesis, by means of functional diagnostic studies. The necessity and efficiency of morphometric study of the stomach of rats of different ages in postnatal ontogenesis is a reasonable fact.

Key words: rats, stomach, abdominal cavity, stomach capacity, stomach shapes, lesser and greater curvature.

Introduction: In postnatal development determine the formation of anatomico-topographic relationships of internal organs and inter-organ interactions in humans and animals. Determine the influence of a given organ on the development of neighboring organs and their reciprocal influence, which depends on their size. The functional activity of the organs under overload determines adequate morphogenesis by changing the absolute and relative growth (T.O.Daminov et al.,2012,IlyasovA.S, TursunovaSh.M. 2021).

Research A.D.Nozdracheva et al. (2016) found that due to the muscular layer of the stomach stirs food, forming chyme, which is removed in separate portions from the stomach through the pylorus canal. The authors state that depending on the consistency of the food, it remains in the stomach from 20 minutes (juices and broths) to 6 hours (meat dishes).

It is known that the stomach of rodents, has two completely different, well-defined parts. The front part of the stomach is lined with multilayer epithelium; here is the exit from the esophagus and the bacterial digestion area. The glandular part of the stomach is lined by secretory epithelium, providing synthesis of acid and proenzymes (M.N. Makarova et al., 2016).

According to V.M.Petrenko (2013) there is a well-defined bridge between the two parts of the stomach. Food enters the pancreas first, where it is fermented by acids and microorganisms. The large curvature of the stomach borders the pancreas and spleen. When crowded, the size of the stomach can reach the size of the main, glandular stomach. The author divides the organs into translucent, pale whitish mucous membrane - cardiac part and opaque muscular part - pyloric part (D.K. Khudoyberdiev et al. Normally, the long axis of the human stomach goes from the left top and back to

the right side down and forward and is almost in the frontal plane (E.V.Petrenko, 2016; D.K.Khudoyberdiev, 2019).

According to E.V.Petrenko(2016) the stomach of the white rat is characterized by the following features: Large steep and small short curvature. A narrow esophagus opens in the middle of the small curvature. The author believes that in humans, the esophagus opens in the region of the cardia and has the smallest distance between the entrance and exit orifice of the stomach.

Literature data show that the stomach of the white rat is more curved and has a relatively constant hook-shaped shape. When food enters and accumulates in the stomach, it increases in size due to the stretching of the serous membrane. Despite the similarity of the structure, shape and location of the stomach of mammals, the stomach and the human stomach have distinctive features.

It is recommended to take these peculiarities into consideration during scientific works and operative interventions in gastroenterology. But in the literature the age dynamics of growth, development and regularities of location and macroscopic structure of the rat stomach in the periods of postnatal ontogenesis are insufficiently studied.

To study anatomico-topographic features of the rat stomach structure and to determine its growth and development patterns in the period of early postnatal ontogenesis using functionally diagnostic methods of research.

Materials and methods of the research.

The work was carried out on 14 outbred rats. The rats were kept in usual conditions.

Rats were decapitated against the background of general inhalation anesthesia with isoflurane in all animals, one by one, the usual sectional removal of anterior chest and abdominal cavity walls was carried out and their contents were photographed. After that, traditional anatomical dissection was resorted to, which consisted in the extraction of the stomach from the abdominal cavity.

In the period of early postnatal ontogenesis, morphometric measurements with a caliper (in cm) were performed at 21 days of age.

Stomach length was measured at the levels of the odontated points of the fundus and pyloric region. The width of the organ was measured at the levels of the fundus, body and pyloric part of the organ.Large and small curvature of the stomach was measured. At the level of the small curvature of the stomach two openings were revealed - esophageal and duodenal, distances between the openings were measured, and the length of the abdominal part of the esophagus was measured in cm.

Ultrasound study determined the borders of abdominal cavity of rats in the age aspect, which is bordered: from above - by rib-arc, from below - by iliac crests, pelvic bone, inguinal ligaments and upper edge of pubic junction - symphysis. The lateral border runs along the vertical lines connecting the ends of the ribs with the anteroposterior axes, where the abdominal cavity volume in rats is revealed (cm3).

To reveal the topographic and anatomical boundaries and areas of the abdomen in rats two horizontal lines were drawn: upper intercostal (lineacostarum) and lower intercostal (linea spinarum), thus the abdominal wall of rats was divided into three areas: upper - epigastric, middle - mesogastric and lower - hypogastric.

In dynamics, the rat's stomach changes its position in these areas during development. Based on the proportion of the stomach located in the regions of the abdominal cavity, determine the percentage of the rats' stomach to identify the location of the stomach in these regions of the abdominal cavity.

In studying the volume of the stomach (in cm3) of rats in different age groups we used Archimedes' law, which is the law of fluid statistics in the stomach cavity, through the esophagus we injected water with a probe while the second opening - pyloric sphincter of the stomach was covered with surgical tweezers. An expulsive force equal to the weight of the liquid volume displaced by the body part immersed in the liquid acts on the liquid.

Statistical processing of the morphological data was carried out directly from the general matrix of the MicrosoftOffice data program package "Excel 7.0" on the Pentium-IV personal computer using the program "STTGRAPH 5.1" to determine indices of the standard deviation and errors of representativeness.

Results of the study

It is known that the rat's stomach is an extended part of the digestive tract and a receptacle for food.

By 21 days of age, the rat stomach is located in the left side of the abdomen at the level of the XII thoracic and I lumbar vertebrae, with its long axis directed transversely to the sagittal plane. The rat stomach with the transition to definitive feeding is often stock-shaped - 21,4%, hook-shaped - 25,6%, yak-shaped - 35,7% and less often shoe-shaped - 14,3%.

On ultrasound examination of the abdomen (Fig. 7), at this age, the abdominal borders at the top are limited by the rib arches, at the bottom by the iliac crests, pelvic bone, inguinal ligaments, and the upper edge of the symphysis pubic joint. The lateral border runs along the vertical lines connecting the ends of the last thoracic ribs with the anterior superior spines. The volume of the abdominal cavity in 21-day-old rats averaged 19.0±0.15 cm3. The 21-day-old rat's gastric capacity coefficient averaged - 6.98±0.30%.

To reveal the topographic-anatomical boundaries and areas of the abdomen in 21-day-old rats, two horizontal lines were drawn: the upper one - intercostal and the lower one - intercostal. The abdominal wall is divided into three regions: the upper region is epigastric, the middle region is mesogastric and the lower region is hypogastric.

With transition to definitive feeding by 21 days of life, the stomach is located in the upper floor of the epigastric region of the abdomen and is equal on average to 1.66±0.01 cm, the middle floor of the mesogastric region to 1.50±0.04 cm3 (55% in the epigastrium and 45% in the mesogastrium). At this age, the rat stomach has two surfaces The anterior lower surface is in contact with the diaphragm and with the abdominal wall and the covered left lobe of the liver. The posterior upper surface is located under the liver closer to the spine at the level of the 12th thoracic vertebra behind the peritoneal space.

Figure 1: Transparent and opaque part of the stomach of 21 day-old rats with a limiting ridge. 1. Transparent part. 2. Opaque part.3. crest.4. The abdominal part of the esophagus.

According to the location of the stomach in 21-day-old rats, three sections are distinguished: the fundus - facing the diaphragm, the body - facing the abdominal wall, and the pyloric section facing the liver gate.

Stomach length in 21 day-old rats is on the average - 3,15±0,05 cm, at the level of organ fundus the stomach width in 21 day-old rats is on the average - 2,04±0,09 cm, at the level of stomach body - 2,82±0,09 cm, at the level of pyloric part of stomach - 2,16±0,08 cm

The anterior wall of the stomach in the vertical plane of 21-day-old rats is divided into two parts: transparent and opaque. It is a limiting ridge, which passes just below the esophagus in the middle of the circumference of the large and small curvature of the organ. The transparent part is the vestibule of the stomach - receiving food and serving as a receptacle for it. The length of the transparent part in 21 day-old rats is on average 2.69±0.05 cm. The non-transparent part is located somewhat to the right in the abdominal cavity in it a pronounced pyloric sphincter, which controls the progression of food from the body of the stomach toward the duodenum. In this photo, we filled the stomach with colorless gel to show the transparent and opaque portion.

By 21 days of development, the large curvature of the rat stomach is located caudally, it is mobile, it faces the anterior abdominal wall and is relatively more mobile than the small curvature. In 21 day-old rats, the length of the greater curvature averaged 3.52±0.14 cm.

Small curvature of stomach in 21 diurnal rats was located proximally under the liver and from above it faced the vertebral column. The length of the small curvature in 21 day-old rats averaged 6.62±0.10 cm.

The abdominal part of the esophagus opens in the middle of the small curvature of the stomach, forming the entrance to the stomach, here the mucosa of the esophagus bending completely surrounds the esophageal opening forming the esophagogastric flap of the stomach, in the form of a leaf. By day 21, the length of abdominal part of rat esophagus averaged 0.33±0.001 cm.

Along the small curvature on the right, at some distance from the esophageal opening, there is a second opening - the pyloric part of the stomach, where the pyloric sphincter of the rat stomach is located, passing into the initial part of the duodenum. The interspace between two stomach orifices in 21-day-old rats averaged 0.60±0.01 cm.

In 21-day-old rats, the capacity of the stomach was on the average - 1,30±0,05 cm3, of which the transparent part was on the average - 1,11±0,04 cm3, the opaque part - 0,19±0,01 cm3. Table 2 shows the abdominal capacity and gastric capacity factor of rats in early postnatal ontogeny.

In rats at 21 days of life, with the transition to mixed feeding, the stomach increases in size by increasing the large curvature of the stomach; when the rat stomach is full, it hangs over the ventral esophagus and the pyloric portion of the duodenum, which is in the middle of the small curvature. The bottom of the stomach when the organ is empty is somewhat cranial under the diaphragm, when the stomach is full it is slightly lowered downwards, due to an increase in the large curvature of the organ, which is down and forward dangling, taking the form of an anchor in the abdominal cavity.

Thus, it is revealed that by the end of early postnatal ontogenesis at 21 days of development the shape of the stomach is most common in the form of a horseshoe. In our opinion, a great variety of stomach shapes of rats in early postnatal ontogenesis is associated with omnivorousness and a variety of food types. The highest rate of increase in the stomach capacity and the length of the abdominal part of the esophagus were revealed at 21 days of life of rats by 45.8% and 19.2% in relation to 16 days of age, respectively.

In the period of early postnatal ontogenesis (at age), ultrasound examination of the abdominal cavity revealed the boundaries of the abdominal cavity of rats. The wall at the top is bounded by rib arches, at the bottom - by iliac crests, pelvic bone, inguinal ligaments and upper edge of pubic joint - symphysis. The lateral border runs along the vertical lines connecting the ends of the XII ribs with the anteromedial appendages of the animal iliac bone.

Conclusion.

1) By the end of early postnatal ontogenesis at 21 days of life, the shape of the stomach is the most common as a horseshoe and the least common as a shoe.

2) The topographic-anatomical boundaries and areas of the stomach in rats are revealed. For this purpose, two horizontal lines were drawn: upper intercostal and lower intercostal; thus, the abdominal wall of rats was divided into three regions: upper - epigastric, middle - mesogastric, and lower - hypogastric, to reveal the proportion of stomach location in epigastrium averaged 1.66±0.01 cm, middle floor mesogastric region 1.50±0.04 cm3 (55% in epigastrium and 45% mesogastric) in these regions of abdomen.

3) In rats, the abdominal part of the esophagus opens in the middle of the small curvature of the stomach, forming the entrance to the stomach in 21-day-old rats, the entrance to the stomach is as follows: here the mucosa of the esophagus curves completely around the esophageal opening, forming an esophageo-gastric flap in the form of a leaf.

4) With the transition to a mixed diet at 21 days of life, the rat's stomach increases in size by increasing the large curvature. Filled with peptic stomach of rats dangles caudally, acquiring the shape of an anchor on the abdominal part of the esophagus and the pyloric part of the duodenum.

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